

LIFE HISTORY AND HABITS OF THE FLAT GRAIN BEETLE (*LÆMOPHLÆUS MINUTUS* OLIV.)

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Although the flat grain beetle is one of the common pests in mills and warehouses, neither its life history nor food habits have been accurately determined. Cotton (1941) considers that the flat grain beetle is not a primary pest of grain but a secondary invader because it follows attack of the more vigorous insects such as the rice weevil. Portchinsky (1913) classifies the flat grain beetle as merely an insect occurring in grain, not a real pest.

FOOD HABITS

Flat grain beetles do live in the cultures of grain weevils, not only live but thrive. The question arises, then, do they have to live on something produced by the grain weevil? Cultures were set up accordingly (1) in the siftings from a weevil culture; (2) in a mixture of shorts and siftings and (3) in shorts alone. One culture was grown in equal parts of shorts and finely ground sulfur. Beetles thrived in all media but contrary to expectation lived as well in shorts as in the grain weevil siftings or in the shorts plus siftings. Presence of sulfur did not retard their development. Since cultures in whole wheat flour or shorts are easier to maintain than those in siftings, the flat grain beetles are now cultured in shorts. Raising insects in siftings is difficult because the siftings from weevil cultures often become moldy and tend to cake in the rearing bottles. Flat grain beetles can live in sound food. They cannot feed on unbroken grain, probably for the reason that *Tribolium* cannot, namely, the mouth parts are not adapted to boring in through the hard coat of the grain, and the whole grain is too large for them to chew.

Flat grain beetles can live on a high protein diet of fish meal and shorts. They do not show, however, any tendency to cannibalism. Over a period of several years no flat beetle has been observed eating another or eating the immature stages. If cannibalism does occur it is rare.

METHODS OF TRANSFERRING

Since flat grain beetles both jump and fly, transfer by brush is difficult. The adult beetles, however, do climb up filter paper or paper toweling. When they are actively climbing they do not usually attempt to jump or fly, unless they are in direct sunlight. Tapping the paper lightly will dislodge the beetles clinging to it. Larvæ will also climb rough surfaces but are not easily removed by tapping. They can be brushed off without injuring them if the brushing is done with care. Eggs may be seen with a hand lens and may be transferred with a small brush from culture to culture.

LIFE HISTORY

Insects were reared in a cabinet which usually stayed at 78° F. (25.5° C.) but for a few hours fell to 75° F. (23.8° C.). Humidity was maintained close to saturation by means of saturated peat moss. When the cabinet was opened, relative humidity would fall sharply.

Information on the length of the various stages was obtained simultaneously. Mated adults were placed in a vial, then removed after one day. Eggs laid by these adults were kept under observation till they hatched. The prepupal and pupal stages were determined by isolating full-grown larvæ, watching them spin cocoons, then isolating the cocoons. Data on the various stages were also obtained by observing the offspring of a pair of beetles throughout the immature stages. The sum of the durations of the stages, which were studied simultaneously, were thus checked by the length of time required for the same individuals to complete their development. In other words the individual parts of the life cycle were determined both in sequence and simultaneously.

Eggs are laid in the food stuff. They are elongated and white. When first laid they are sticky enough for food particles to adhere to them. At the temperatures of the experiment the duration of the egg stages was 8-10 days.

From hatching of eggs to the time of spinning a cocoon was from 26 to 36 days, for the bulk of the culture. Some stragglers required as long as 45 days to complete the larval stage. The larvæ are typically Cucujidæ with typical hooked anal appen-

ages. Their hard, flat appearance contrasts strongly with the subcylindrical *Tribolium* larvæ which are generally found with them in a natural infestation.

When larvæ become full grown they spin cylindrical cocoons. In some cases the ends of these are so flat as to suggest segments of a coarse woolly thread cut off with scissors. If the cocoons happen to be spun against a glass surface they are somewhat flattened. The side of the cocoon next to the glass remains transparent so that observations can be made of changes in the cocoon. The prepupal stage takes about two days. When the larva begins to spin it is still of full length. Inside the cocoon it shortens and gradually assumes a prepupal state. The pupal stage proper lasts 6-9 days. When the adult breaks to pupal skin to emerge, it is white as are other freshly emerged Coleoptera. The white adult, however, does not break through the cocoon, but becomes brown and hard before emerging. Adults emerge through the end of the cocoon. In cultures, white adults never appear for the reason that they remain in the cocoon. Young adults can, however, be told from older ones by their bright brown color. Older beetles gradually become a dull black.

Adults live for months. Freshly emerged adults were isolated on the 24th of June. Both males and females were living in December. Females may live as long as a year. Individual records of fecundity were not kept but the offspring from a single pair of beetles mated June 15 was somewhat over one thousand by December. These beetles were given adequate food and living space but no other care.

SUMMARY

1. The flat grain beetle (*Læmophlæus minutus* Oliv.) can be reared on whole wheat flour or shorts as well as on siftings from weevil cultures.

2. *L. minutus* may live as a scavenger but can live on sound material.

3. At 78° F. and humidity near saturation the duration of the immature stages is 46-57 days. Adults live from 6 months to a year.

REFERENCES

- COTTON, RICHARD T. 1941. Insect pests of stored grain and grain products. Identification, habits and methods of control. 242 pp. See pp. 18-19.
- PORTCHINSKY, I. A. 1913. Insects injurious to grain in stores and warehouses. Mem. Bur. Ent. Sci. Com. Cent. Bd. Land Admin. and Agr., 10, No. 5. (In Russian.)